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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/715,376	11/19/2003	Jonathan Zanhong Sun	YOR920030332US1	5483

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EXAMINER	
NGUYEN, THINH T	
ART UNIT	**PAPER NUMBER**
2818	

DATE MAILED: 08/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No.	Applicant(s)	
	10/715,376	SUN ET AL.	
	Examiner	Art Unit	
	Thinh T. Nguyen	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 July 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7 and 9-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,9-28* is/are rejected.

7)☒ Claim(s) *17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 November 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED OFFICE ACTION

1. Applicant election of claims 1-28 without traverse in the communication with the Office on 7/14/2005 is acknowledged. Noted that claim 8 is missing in the claims set , therefore only claims 1-7,9-28 are pending in the application.

Specification

2. The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant cooperation is requested in correcting any errors of which the applicant may become aware in the specification.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a) because they fail to show [the embodiment of the memory cell wherein the barrier layer is not in the magnetic pillar] as described in the specification page 9 lines 13-14 . Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement-drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from

the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled Replacement Sheet in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

4. The Drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the drawing of a magnetic memory. wherein at least one of the second lead includes a magnetic layer of the plurality of the magnetic layers (in claim 13) must be shown or the features cancelled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in the reply to the Office Action to avoid abandonment of the Application. The objection to the drawings will not be held in abeyance.

Claim Objection

5. The Claim numbering is objected to since claim 8 is missing. Correction is required.

6. Claim 17 is objected to for the following informality:

In claim 17 " **anistropy** " should be -- anisotropy --.

Correction is required.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102(a/b/e) that form the basis for the rejections under this section made in this office action.

A person shall be entitled to a patent unless --

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claim 1, 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen et al. (U.S. Patent 5,917,749).

REGARDING CLAIM 1

Chen (fig 1,fig2,fig 3, column 2 lines 40-44,column 4 line 40) discloses a spin-current switched magnetic memory element, comprising: a plurality of magnetic layers, at least one of the plurality of magnetic layers (fig 3 layer 11,13) having a perpendicular magnetic anisotropy

component and comprising a current-switchable magnetic moment; and at least one barrier layer(fig 3 layer 12) formed adjacent to the plurality of magnetic layers.

FIG. 1

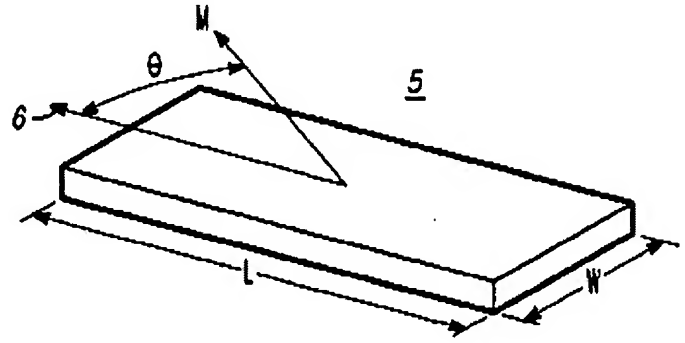
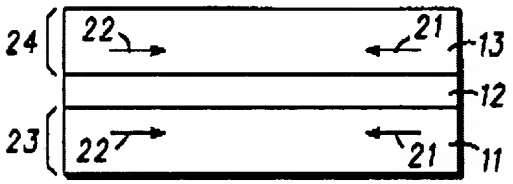


FIG. 2



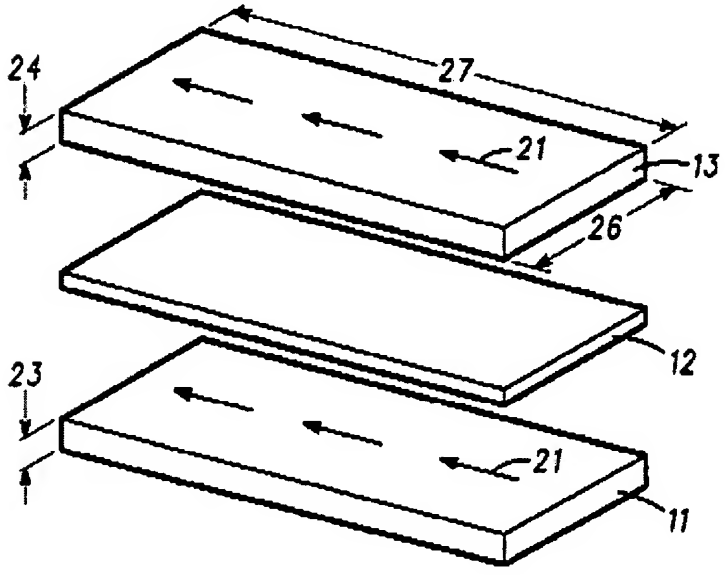


FIG. 3

10

REGARDING CLAIM 14

Chen discloses (fig 3) a spin-switched magnetic element wherein the plurality of magnetic layers comprises an upper magnetic layer (fig 3 layer 13) and a lower magnetic

layer (fig 3 layer 11) , the at least one barrier layer (fig 3 layer 12) being formed between the upper and lower magnetic layers.

9. Claim 2, 9, 10,12, 20,21, 25- 28 are rejected under 35 U.S.C. 102(e) as being anticipated by Ikeda (US patent 6,721,201)

REGARDING CLAIM 2

Ikeda (in the abstract , in fig 9) discloses a spin-current switched magnetic memory element, comprising: a plurality of magnetic layers fig 9 layer 355,354), at least one of the plurality of magnetic layers having a perpendicular magnetic anisotropy component (the abstract lines 3-4) and comprising a current-switchable magnetic moment; and at least one barrier layer (fig 9 layer 105) formed adjacent to the plurality of magnetic layers and wherein said plurality of magnetic layers comprises at least one composite layer (the abstract lines 5-7) . Noted that Ikeda discloses a tunneling magnetoresistive device (column 7 lines 5-6) therefore it is inherently a spin switched magnetic memory device.

REGARDING CLAIM 9

Ikeda (in the abstract , in fig 9) discloses a spin-current switched magnetic memory element comprising: first and second leads (fig 9 layer 332 layer 358) ; and a pillar formed between said first and second leads, said pillar including said at least one barrier layer (fig 9 layer 105) and at least one magnetic layer (fig 9 layer 354 or 355) of said plurality of magnetic layers.

REGARDING CLAIM 10

Ikeda discloses a tunneling magnetoresistive device (column 7 lines 5-6) that operates by flowing a current into a lead (column 3 lines 56-59) therefore it is inherently a spin current switched magnetic memory device.

REGARDING CLAIM 12

Ikeda discloses a TMR Tunneling Magnetoresistive device (column 7 lines 5-6) with a non-magnetic insulator Al2O3 (column 7 line 8) known in the art as spin-valve current switched magnetic memory therefore barrier layer inherently preserves spin information for an electric current injected into said pillar and provides a resistance to said current. (see the Ikeda reference column 2 lines 60-67,column 3 lines 1-3).

REGARDING CLAIM 20,21

Ikeda (in the abstract , in fig 9) discloses a spin-current switched magnetic memory element, comprising: first and second leads (fig 9 layer 332 and 358) ; formed between the first and second leads, a plurality of magnetic layers(fig 9 layers 355,354) , at least one of the plurality of magnetic layers having a perpendicular magnetic anisotropy component (the abstract) and comprising a current-switchable magnetic moment; wherein one barrier layer comprise a tunneling barrier (column 7 line s 5-6) and comprises Aluminum Oxide (column 7 lines 5-10) .

REGARDING CLAIM 25

Ikeda (in the abstract, in fig 9) discloses a spin-current switched magnetic memory element with pillar wherein the pillar has an electrical resistance, which depends on a

magnetization direction of the lower magnetic layer with respect to a magnetization direction of the upper layer.

Noted that Ikeda discloses a tunneling magnetoresistive device (column 7 lines 5-6) therefore it is inherently having all the attributes as recited in claim 25.

REGARDING CLAIM 26

Ikeda discloses a tunneling magnetoresistive device (column 7 lines 5-6).

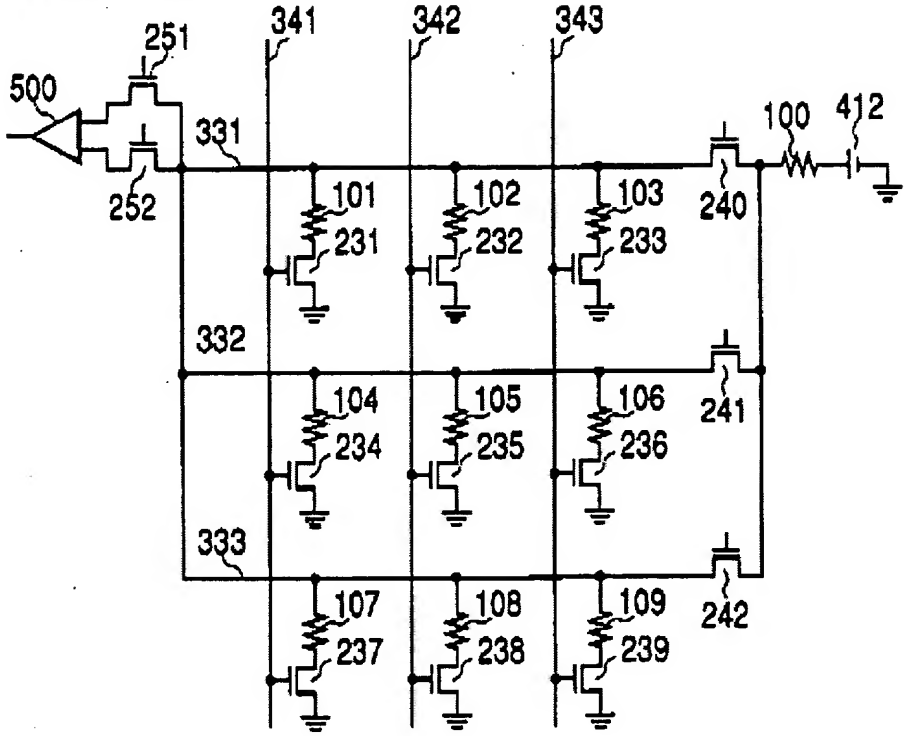
REGARDING CLAIM 27

Ikeda (in the abstract , in fig 9) discloses a spin-current switched magnetic memory element, comprising: first and second leads (fig 9 layer 332 and 358) ; formed between the first and second leads, a plurality of magnetic layers(fig 9 layers 355,354) , at least one of the plurality of magnetic layers having a perpendicular magnetic anisotropy component (the abstract) and comprising a current-switchable magnetic moment; and at least one barrier layer (fig 9 layer 105) formed in the pillar adjacent to the plurality of magnetic layers. Noted that Ikeda discloses a tunneling magnetoresistive device (column 7 lines 5-6) therefore it is inherently a spin switched magnetic memory device.

REGARDING CLAIM 28

Ikeda (Fig 8) discloses a memory array comprising of magnetic spin current switched magnetic elements

FIG. 8


251
341
342
343
500
331
100
412
252
101
231
102
232
103
233
240
332
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234
105
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106
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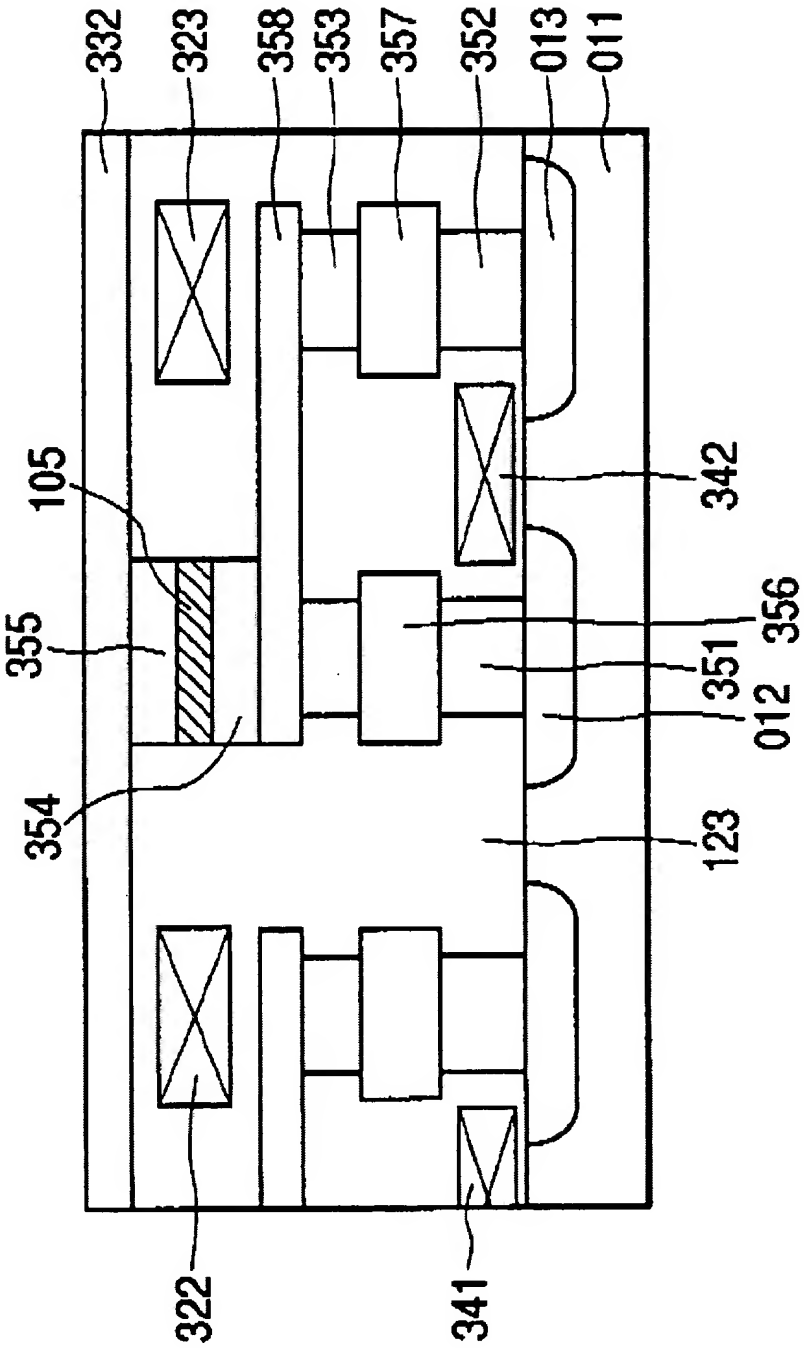
FIG. 9

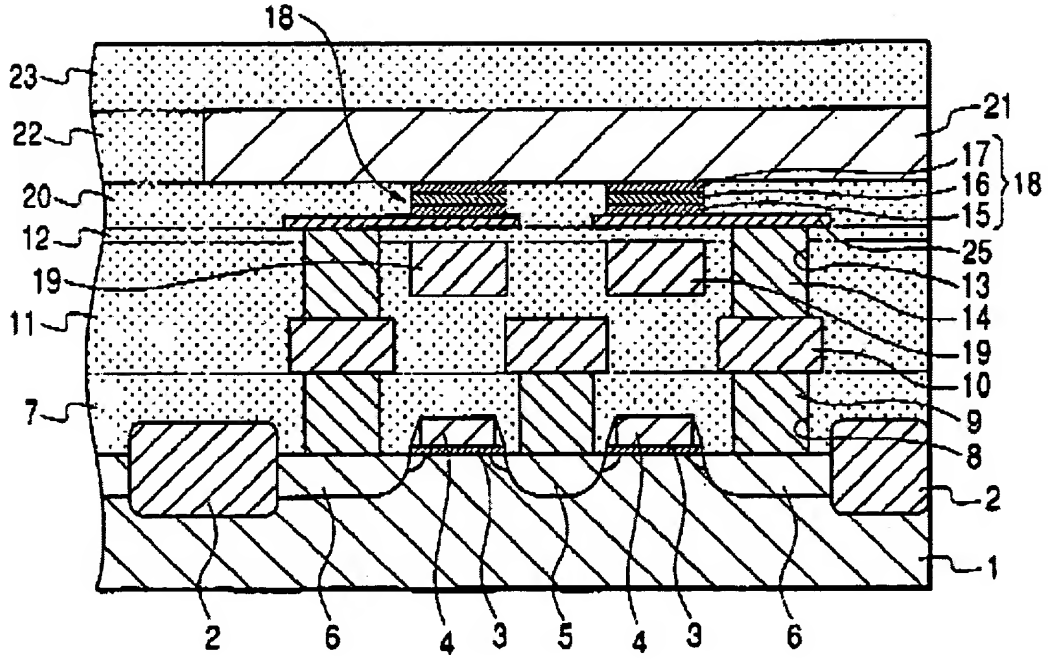

332
323
358
353
357
352
013
011
105
342
355
356
351
012
354
123
322
341

10. Claim 14 is rejected under 35 U.S.C. 102(e) as being anticipated by Hirai et al. (US patent 6,703,676) or Dieny et al. (US patent Application Publication 2005/0002228 A1).

REGARDING CLAIM 14

Hirai (the abstract, fig 1B) discloses a spin-current switched magnetic memory element, (fig 1B element 18) comprising: a plurality of magnetic layers(fig 1B layer 15,17), at least one of said plurality of magnetic layers having a perpendicular magnetic anisotropy component (the abstract, lines 5-6) and comprising a current-switchable magnetic moment; and at least one barrier layer (fig 1B layer 16) formed adjacent to said plurality of magnetic layers.

FIG. 1B



Similarly Dieny et al. (fig 3, paragraph [0118], paragraph [0122], magnetic layer 20a, magnetic layer 20c, barrier layer 20b disclose the same invention.

11. Claim 3,5,15,16, 22, 24 are under 35 U.S.C. 102(e) as being anticipated by Dieny et al. (US patent Application Publication US 2005/0002228).

REGARDING CLAIM 3

Dieny et al. (fig. 3, paragraph [0118], paragraph [0122]) discloses a spin-current switched magnetic memory element wherein the at least one composite layer comprises a platinum layer and a cobalt layer.

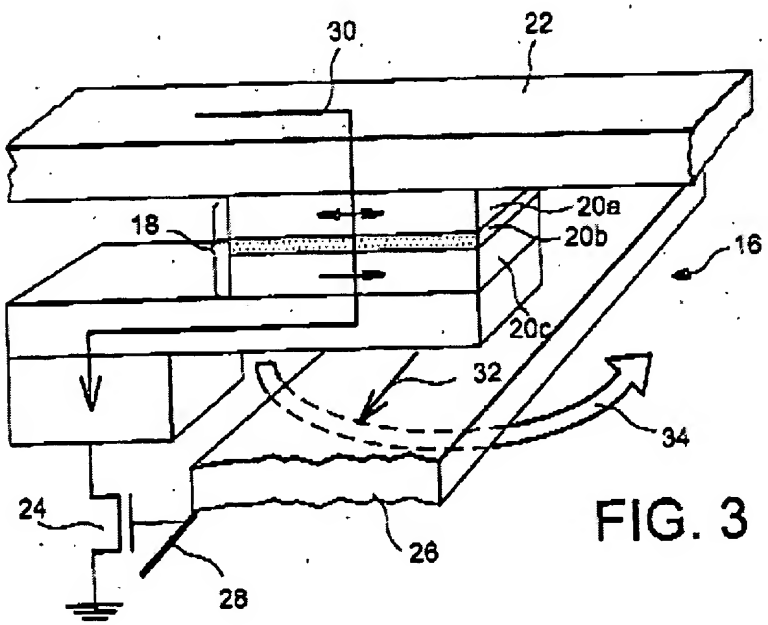


FIG. 3

REGARDING CLAIM 5

Dieny et al. (fig. 3, fig 4, paragraph [0118], paragraph [0125]) discloses a spin-current switched magnetic memory element wherein the at least one composite layer comprises a Nickel (Ni) layer and a copper (Cu) layer.

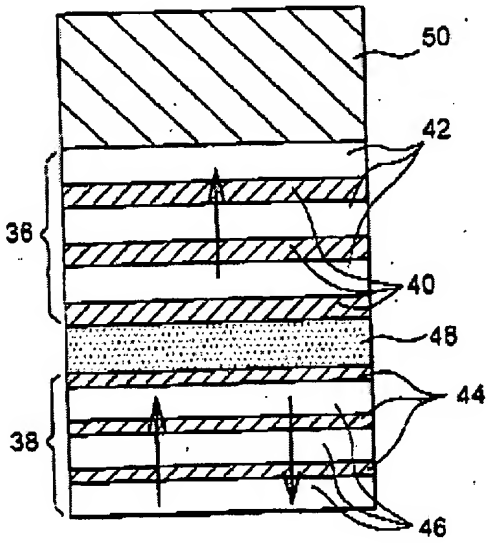
REGARDING CLAIM 15

Dieny et al. (fig. 3, fig 4 , paragraph [0118], paragraph [0122]) discloses a spin-current switched magnetic memory element wherein said upper magnetic layer comprises one of a platinum layer formed on a cobalt layer.

REGARDING CLAIM 16

Dieny et al. (fig. 3, fig 4, paragraph [0118], paragraph [0122]) discloses a spin-current switched magnetic memory element wherein said lower magnetic layer comprises one of a platinum layer formed on a cobalt layer.

FIG. 4



REGARDING CLAIM 22

Dieny et al. (fig. 3, fig 4, paragraph [0118], paragraph [0125]) discloses a spin-current switched magnetic memory element wherein the lower layer magnetic layer comprises a first

Nickel layer formed on the first copper layer and the upper layer comprises a second copper layer formed on a second nickel layer.

REGARDING CLAIM 24

Dieny et al. (fig. 3, fig 4, paragraph [0118], paragraph [0122]) discloses a spin-current switched magnetic memory element wherein the lower layer magnetic layer comprises a first Nickel layer formed on the first platinum layer and the upper layer comprises a second platinum layer formed on a second platinum layer.

Claim Rejections - 35 USC § 103

12. The following is a quotation of U.S.C. 103(a) which form the basis for all obviousness rejections set forth in this office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

13. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al.(U.S. patent 6,703,676) in view of Pakala et al. (US patent Application Publication US 2005/0106810 A).

REGARDING CLAIM 4

Hirai (the abstract, fig 1B) discloses all the invention except for the formation of a gold cobalt layer, Pakala, however,(paragraph [0037]) teaches how to make a magnetic layers using Cobalt (Co) and Gold (Au)

It would have been obvious to one of ordinary skill in the art the time the invention was made to combine the teachings by Hirai with the teachings by Pakala and come up with the invention of claim 4.

The rationale is as the following:

A person skilled in the art at the time the invention was made would have been motivated to make the device invented by Hirai to be thermally stable as suggested by Pakala in his abstract.

14. Claims 6, 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. (U.S. patent 6,703,676) in view of Iwasaki (U.S. patent 6,625,058).

REGARDING CLAIM 6

Hirai (the abstract, fig 1B) discloses all the invention except for the formation of magnetic anisotropy at the interface of a magnetic and non-magnetic material, Iwasaki, however, (column 7 line 18-24) teaches how to make a magnetic anisotropy using interface between a magnetic and non-magnetic material (Cobalt and Gold for example).

It would have been obvious to one of ordinary skill in the art the time the invention was made to combine the teachings by Hirai with the teachings by Iwasaki and come up with the invention of claim 6.

The rationale is as the following:

A person skilled in the art at the time the invention was made would have been motivated to make the device by Ikeda easier for production as suggested by Iwasaki (column 3 lines 6-12).

REGARDING CLAIM 7

Hirai (the abstract, fig 1B) discloses all the invention except for the formation of magnetic anisotropy at the using bulk anisotropy magnetic material, Iwasaki, however, (column 8 lines 25-30) teaches how to make a magnetic anisotropy using bulk anisotropy magnetic material.

The reason why claim 7 is obvious over prior art has been discussed in the rejection of claim 6.

15. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ikeda (U.S. patent 6,701, 201) in view of Elliot et al. (IEEE transaction on magnetics, volume 38 no 5 September 2002).

REGARDING CLAIM 11

Ikeda (the abstract, fig 9) discloses all the invention except for the condition wherein the magnetic moment of the at least one magnetic layer included in the pillar is switchable by an electrical current having a density of no more than about 10.sup.6 A/cm.sup.2. Elliot, however, discloses a spin switched magnetic element that can switch with a current density of 10.sup.5 A/cm2 (Elliot abstract line 16)

It would have been obvious to one of ordinary skill in the art the time the invention was made to combine the teachings by Ikeda with the teachings by Elliot and come up with the invention of claim 11.

The rationale is as the following:

A person skilled in the art at the time the invention was made would have been motivated to reduce the switching current density of the Ikeda device using the teachings by Elliot.

16. Claim 13 is rejected under 35 U.S.C. 103(a) is rejected under 35 U.S.C. 103(a) as being unpatentable over Ikeda (U.S. patent 6,721, 201) in view of Nakada et al. (US patent 6,341,053).

Ikeda (the abstract, fig 9) discloses all the invention except for a lead or electrode that includes a magnetic layer. Nakada, however, (in fig 1,column 4 line 58-65) discloses a lead (layer 12) that can includes a magnetic layer 13.

It would have been obvious to one of ordinary skill in the art the time the invention was made to combine the teachings by Ikeda with the teachings by Nakada and come up with the invention of claim 13.

The rationale is as the following:

A person skilled in the art at the time the invention was made would have been motivated to reduce the signal to noise ratio (column 2 lines 14-15) of the Ikeda device as suggested by Nakada.

17. Claims 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ikeda (U.S. patent 6,721, 201) in view of further remark.

REGARDING CLAIM 17

Ikeda (the abstract, fig 9) discloses all the invention except for the condition wherein Wherein the perpendicular magnetic anisotropy has a magnitude sufficient to at least substantially offset an easy-plane demagnetization effect, such that a magnetic moment of one of the upper and lower magnetic layers is either resting out of the film plane or can be rotated out of the film plane under spin current excitation.

This limitation, however, is considered obvious since it has been held that when the general conditions of a claim are disclosed in the prior art; discovering the optimum or workable range involves only routine ordinary skill in the art.

A person skilled in the art at the time the invention was made would be able to use the teachings by Ikeda and his routine design skill and come up with the invention of claim 17 for the purpose of improving the device invented by Ikeda.

18. Claim 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US patent (US patent 5,917,749) in view of Inomata et al. (US patent 6,069,820).

REGARDING CLAIM 18

Chen (fig 1,fig 2,fig 3) discloses all the invention including a spin-current switched magnetic memory element except for a barrier layer that comprises a plurality of barrier layers which are alternately formed with the plurality of magnetic layers. Inomata, however (fig 7, fig 18,fig 19) , discloses a spin valves current switched memory devices with a barrier layer that comprises a plurality of barrier layers which are alternately formed with the plurality of magnetic layers.

It would have been obvious to one of ordinary skill in the art the time the invention was made to combine the teachings by Chen with the teachings by Inomata and come up with the invention of claim 18.

The rationale is as the following:

A person skilled in the art at the time the invention was made would have been motivated to make improve the device invented by Chen to make it has a higher Magnetoresistive amplitude as suggested by Inomata (column 3 lines 6-10).

19. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US patent (US patent 5,917,749) in view of Deak. (US patent 6,728,132) and in further view remark.

REGARDING CLAIM 19

Chen (fig 1,fig 2,fig 3) discloses all the invention except for the use a oblong shape pillar. Deak; however, disclose that the pillar can be oblong shaped. It would have been obvious to one of ordinary skill in the art the time the invention was made to combine the teachings by Chen with the teachings by Inomata and come up with Memory cell structure with pillar that is oblong shaped.

The rationale is as the following: A person skilled in the art at the time the invention was made would have been motivated to select the shape that is suitable for a particular application.

As explained above the combined teachings by Chen and Deak disclose all the invention of claim 19 except for the lithographic diameter of the pillar. This feature however is considered obvious since it has been held that where all the general conditions of a claim are disclosed in the prior art; discovering the optimum value or the workable range is of ordinary skill in the art.

A person skilled in the art at the time the invention was made would have been capable from using the teachings by Chen and Deak and his own routine design skill and come up with the invention of claim 19 for the purpose of improving the semiconductor memory device.

20. Claim 23 is rejected under 35 under 35 U.S.C. 103(a) as being unpatentable over Dieny et al. (US patent Application Publication 2005/000228 A1) in view of further remark.

REGARDING CLAIM 23

Dieny (fig 3,fig 4) discloses all the invention except for the condition wherein the second nickel layer have a thickness that is different from the first nickel layer.

This limitation, however, is considered obvious since it has been held that where all the general conditions of a claim are disclosed in the prior art; discovering the optimum value or the workable range is of ordinary skill in the art.

21. When responding to the office action, Applicants are advised to provide the examiner with the line numbers and the page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

22. A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to be abandoned (see M.P.E.P. 710.02(b)).

CONCLUSION

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thinh T Nguyen whose telephone number is 571-272-1790.

The examiner can normally be reached on Monday-Friday 9:00am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached at 571-272-1787.

The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval [PAIR] system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thinh T. Nguyen

Art Unit 2818